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Dear Dr. Faller:

This is in response to your letter of March 29, 2003, requesting Federal Highway Administration (FHWA) acceptance of the ROO GUARDS, INC. single, water filled barricade system with an attached warning light as a crashworthy traffic control device for use in work zones on the National Highway System (NHS). Accompanying your letter were reports of bogie crash testing you conducted and video of the tests. You requested that we find these devices acceptable for use on the NHS under the provisions of National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

### **Introduction**

The FHWA guidance on crash testing of work zone traffic control devices is contained in two memoranda. The first, dated July 25, 1997, titled "INFORMATION: Identifying Acceptable Highway Safety Features," established four categories of work zone devices: Category I devices were those lightweight devices which could be self-certified by the vendor, Category II devices were other lightweight devices which needed individual crash testing, Category III devices were barriers and other fixed or massive devices also needing crash testing, and Category IV devices were trailer mounted lighted signs, arrow panels, etc. The second guidance memorandum was issued on August 28, 1998, and is titled "INFORMATION: Crash Tested Work Zone Traffic Control Devices." This later memorandum lists devices that are acceptable under Categories I, II, and III.

A brief description of the devices follows:

ROO GUARDS Inc., water filled barricade units are roto-molded, linear low density polyethylene (LLDPE) with a density of  $0.938 \text{ g/cm}^3$ . The overall dimensions of the units are 1994 mm (78.5 inches) long, 876 mm (34.5 inches) tall, 546 mm (21.5 inches) wide at the base,

and 140 mm (5.5 inches) wide at the top. The nominal base thickness is 8.9 mm (0.35 inches.) The bottom vertical face of the unit is 152 mm (6 inches) high. A warning light – “PARALTA – SIGNAL” was set inside the top center of the unit. The light was attached with one 12.7 mm (0.5 inch) diameter x 114.3 mm (4.5 inch) long grade 5 bolt with washers.

Individual ROO GUARDS units weight 29.94 kg (66 pounds). The light added 2.36 kg (5.2 pounds) and the unit was ballasted with 15.45 kg (34 pounds) of water.

### Testing

This crash-testing program used a hard-nosed bogie vehicle of a mass larger than the standard 820C test vehicle. There are significant constraints involved in using such a non-standard testing device, some of which are:

1. The potential vehicle velocity change must be considered insignificant.
2. The crush characteristics of an automobile bumper must not be expected to have a significant affect on the trajectory of the test article.
3. The profile of the bogie vehicle must be configured to replicate the outline of a production vehicle. The Midwest Roadside Safety Facility bogie was configured to replicate the outline of a Geo Metro, a vehicle commonly used in testing of work zone devices.
4. No part of the test article may intrude into the windshield area of the vehicle after impact.

The two tests and their results summarized below were within these constraints.

Two stand-alone examples of the devices were tested in separate bogie runs, one head-on and the second turned at 90 degrees, as called for in our guidance memoranda. The tests are summarized in the table below.

|                      | ROO GUARDS Lighted Barricade Units |                          |
|----------------------|------------------------------------|--------------------------|
| Test Number          | ROO-1                              | ROO-2                    |
| Orientation          | Head-on                            | End-on                   |
| Total weight         | 47.72 kg                           | 47.72 kg                 |
| Mounting heights     | 876 mm (34.5 inch*)                | 876 mm (34.5 inch*)      |
| Flags? Lights?       | Light                              | Light                    |
| Mass of Test Vehicle | 929 kg                             |                          |
| Impact Speed         | 100.9 km/hr                        | 100.1 km/hr              |
| Velocity Change      | 4.7 km/hr (1.3 m/s)                | 4.7 km/hr (1.3 m/s)      |
| Extent of contact    | Light struck “hood” area           | Light remained with unit |
| “Windshield” Damage  | No contact                         | No contact               |

- The tested Roo Guard units were 34.5 inches tall. As the Manual on Uniform Traffic Control Devices (MUTCD) requires 3 foot minimum height to the top of a barricade, the tested units are not in compliance. Subsequent to the testing the mold was adjusted to make Roo Guard units that are 36.5 inches tall. If the same total weight of tested unit with water and light is not exceeded when the 36.5 inch tall unit is expected to perform in a similar manner.

## **Findings**

The results of the bogie testing met FHWA requirements for work zone traffic control barricades. Therefore, the ROO GUARDS barricades described above and detailed in the enclosed drawings are acceptable for use on the NHS under the range of conditions tested, or with 36.5 inch tall units, when proposed by a State. Because the weight of the water has a significant affect on the impact performance, the fill mark or other method of regulating the maximum water line must be permanently incorporated into the ROO GUARDS units.

Please note that ROO GUARDS were not tested in a linked configuration simulating a barrier, a configuration known as a longitudinal channelizing barricade. In order to be used as a longitudinal channelizing barricade ROO GUARDS must be crash tested according to NCHRP Report 350 as a longitudinal barrier. As ROO GUARDS are not designed to redirect vehicles at test level 1 (TL-1), TL-2, or TL-3 speeds, special criteria are used by the FHWA to evaluate the crash test performance of longitudinal channelizing barricades. These criteria permit the controlled penetration of the barricade without exposing the vehicle occupants to significant risk of injury.

Please note the following standard provisions that apply to FHWA letters of acceptance:

- Our acceptance is limited to the crashworthiness characteristics of the devices and does not cover their structural features, nor conformity with the MUTCD.
- Any changes that may adversely influence the crashworthiness of the device will require a new acceptance letter.
- Should the FHWA discover that the qualification testing was flawed, that in-service performance reveals unacceptable safety problems, or that the device being marketed is significantly different from the version that was crash tested, it reserves the right to modify or revoke its acceptance.
- You will be expected to supply potential users with sufficient information on design and installation requirements to ensure proper performance.
- You will be expected to certify to potential users that the hardware furnished has essentially the same chemistry, mechanical properties, and geometry as that submitted for acceptance, and that they will meet the crashworthiness requirements of FHWA and NCHRP Report 350.

- To prevent misunderstanding by others, this letter of acceptance, designated as number WZ-154 shall not be reproduced except in full. This letter, and the test documentation upon which this letter is based, is public information. All such letters and documentation may be reviewed at our office upon request.
- The ROO GUARDS are patented devices and considered "proprietary." The use of proprietary work zone traffic control devices in Federal-aid projects is generally of a temporary nature. They are selected by the contractor for use as needed and removed upon completion of the project. Under such conditions they can be presumed to meet requirement "a" given below for the use of proprietary products on Federal-aid projects. On the other hand, if proprietary devices are specified for use on Federal-aid projects, except exempt, non-NHS projects, they: (a) must be supplied through competitive bidding with equally suitable unpatented items; (b) the highway agency must certify that they are essential for synchronization with existing highway facilities or that no equally suitable alternative exists or; (c) they must be used for research or for a distinctive type of construction on relatively short sections of road for experimental purposes. Our regulations concerning proprietary products are contained in Title 23, Code of Federal Regulations, Section 635.411, a copy of which is enclosed.
- This acceptance letter shall not be construed as authorization or consent by FHWA to use, manufacture, or sell any patented device. Patent issues are to be resolved by the applicant and the patent owner.

Sincerely yours,

Michael S. Griffith  
Acting Director, Office of Safety Design  
Office of Safety

Enclosures

FHWA:HSA-10:NArtimovich:tb:x61331:4/29/03

File: h://directory folder/nartimovich/WZ154-ROOGUARDS

cc: HSA-10 (Reader, HSA-1; Chron File, HSA-10;  
N. Artimovich, HSA-10)